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The following is taken from the documents submitted by the applicant.

Request for examination under §44 Patent Law has been submitted.

(54) Display and Method for Driving the Display

(57) Display (10) made of pixels (18) and dots (11). The pixels are generated dynamically. The dynamic pixels (18) are generated variably from the available dots (11). The pixels (18) form a dynamically generated logical unit by combining neighboring dots (11, 13, 14, 15), wherein the neighboring dots (18) are physically overlapping one another.

Description

The invention relates to a display made of pixels and dots, as well as a method for driving this display.

In known displays used for video, film and computer technology, so-called pixels are arranged along horizontal and/or vertical rows. The pixels are ordinarily made of so-called dots, which represent the basic colors red, green and blue. Dots are luminescent light sources, which can generate luminescent mixed colors by light mixing. This is called additive mixing of colors.

In computer monitors and television monitors, the display is partitioned into a multitude of pixels, which are arranged in a fixed grid pattern. The driving of the pixels is carried out individually. Pixels are driven, for example, from left to right and from top to bottom, as is typical for a cathode ray tube.

A disadvantage of these displays is the number of pixels, which is fixed by the grid pattern, and which determines the resolution and sharpness of the image. The finer the grid pattern is, the larger is the resolution. However, the fineness of the grid pattern is limited by the technical manufacturing parameters, because the used cathode ray tubes are provided with so-called shadow masks, and enormous expenses are required to further minimize their holes.

Similarly, the integration of a larger number of transistors in an LCD display is very complex and results in a large number of rejects.

Also in LED displays, the arrangement of the LEDs is complex and expensive, since the spatial requirements are determined by their form.

It is an object of the present invention to provide a display of the above-described kind, which achieves a greater optical resolution in a given grid pattern.

This object is achieved by generating the pixels dynamically. For

this, the pixels are generated variably from the existent dots. By combining neighboring dots, the pixels form a dynamically generated, logical unit, wherein neighboring pixels overlap one another. The dynamic pixels are generated with a speed that is so high, that it cannot be perceived by the human eye. A dynamic pixel should have at least so many dots that all basic colors provided by the dots are contained.

Another object of the present invention is to provide a method that allows a higher resolution of displays that are driven dot by dot.

This object is achieved by dynamically generating pixels by combining neighboring dots to form a dynamically generated logical unit, wherein neighboring pixels overlap one another dynamically. The dynamic pixels are generated with a speed that is so high, that it cannot be perceived by the human eye.

For this, the dots that are combined into one pixel are selected such that neighboring pixels overlap only partially. Thus, another dynamic pixel is formed between the existent and usually static pixels. The pixels are combined such that they contain all basic colors provided by the dots.

Further advantageous measures are described in the dependent claims. The invention is depicted in the attached drawings and is described in more detail below.

Fig. 1a-c show different arrangements of four dots within one square pixel;

Fig. 2a-b show different embodiments of a display with square pixels, wherein the known static pixels are indicated by squares and the dynamic pixels according to the invention are indicated by circles;

Fig. 3a-d show different embodiments of a pixel with the three basic color dots red, green and blue;

Fig. 4a-b show different embodiments of a display with different pixels shapes, wherein the known static pixels are indicated by rectangles and the dynamic pixels according to the invention are indicated by ovals;

Fig. 5 is a display with a controller that is connected through a network with the dot;

Fig. 6 shows the course of the interlaced signals in the generation of an image (or frame) made of two fields;

Fig. 7 shows the course of the interlaced signal for the dynamic pixels according to the present invention;

The pixels 12a, 12b and 12c shown in Fig. 1a to 1c are of square shape. The pixels 12a, 12b and 12c have uniformly arranged dots 11 that radiate the basic colors red (red dot 13), green (green dot 14) and blue (blue dot 15). The pixel in Fig. 1b is made only of red dots 13 and green dots 14. Every dot 11 is preferably surrounded by a mask 21, so that a greater contrast between the dynamic pixels 18 can be achieved. Herein, the precise arrangement of the dots 13, 14 and 15 of different colors is irrelevant. It is only necessary to ensure that the arrangement of the different dots 13, 14 and 15 is identical in each static pixel 17 within a display 10.

The Figs. 2a and 2b show displays 10 and 10a that have square static pixels 17. The static pixels 17 represent a known grid pattern of the display 10 or 10a. The dynamic pixels 18 shown as circles correspond to configurations of the display 10 or 10a in accordance with the present invention. A dynamic pixel 18 includes, like a static pixel 17, four dots 13, 14 and 15, that represent all basic colors.

Different to the static pixels 17, the dynamic pixels 18 overlap, however a complete overlapping should be avoided. High-frequency driving of the dynamic pixels 18 deceives the human eye. The eye will thus perceive a more exact representation of the pictured image.

For a display with quadrilateral pixels 12a, 12b and 12c, the resolution is increased by:

$$P = (x - 1) \cdot y + (2x - 1) \cdot (y - 1)$$

wherein x is the number of pixels in horizontal direction and y is the number of pixels in vertical direction.

For the displays in the Figs. 2a and 2b this value is:

$$P = (3 - 1) \cdot 3 + (2 \cdot 3 - 1) \cdot (3 - 1) = 6 + 10 = 16$$

The display thus has a resolution of 25 = 16 + 9 instead of 9 points.

Figs. 3a to 3d show different forms of pixels 16a, 16b, 16c and 16d, which include three dots 11 each representing the three basic colors. The dots 11 are separated from one another with sharp contours by masks 21.

The dynamic pixels 18 should preferably each contain an equal number of dots 11. Herein, the precise arrangement of the dots 13, 14 and 15 of different colors is irrelevant. Consequently, for a display that is not full color capable for example, it is sufficient if only two basic colors are provided as dots in each pixel, as shown in Fig. 1b.

Figs. 4a and 4b show displays 10b and 10c that are made of the pixels 16a and 16b. For these, the increase in resolution is lower than in the above-described square shape.

Fig. 5 shows a display 10 that is connected through a network 20 with a controller 19. With this controller 19, it is possible to use known dot-driven displays, and to increase their resolution. In the displays according to the present invention, all dots have their own receiver (not shown), which converts digital information sent over the network 20 into the luminescent intensity of the dots 11.

Preferably, the network 20 is a glass fiber network. The controller 19 combines neighboring dots 11 to a dynamic pixel 18, in order to drive them as a logical unit. This driving is performed at high-frequency repetition, preferably at around 100 Hz.

The displays according to the present invention may also be used for interlaced signals, which compose the image from an odd and an even field

24. Herein, the odd field 24 consists of rows 22 with odd numbers, and the even field consists of rows 23 with even numbers. Due to the inertia of the human eye, an image develops that is made of two fields 24. Fig. 6 illustrates the theoretic assembly of the image, and Fig. 7 illustrates the assembly of the image with the dynamic pixels 18 of the present invention. Other dynamic pixel shapes are also conceivable.

List of Reference Numerals

10, 10a, 10b, 10c	display
11	dot
12a, 12b, 12c	pixel
13	red dot
14	green dot
15	blue dot
16a, 16b, 16c, 16d	pixel
17	static pixel
18	dynamic pixel
19	controller
20	network
21	mask
22	odd row
23	even row
24	field

Patent Claims

1. Display made of pixels and dots, characterized in that the pixels (18) are generated dynamically.

2. Display according to claim 1, characterized in that the dynamic pixels (18) are generated variably from the available dots (11, 13, 14 15).

3. Display according to claims 1 and 2, characterized in that the pixels

(18) form a dynamically generated logical unit by grouping together neighboring dots (11, 13, 14, 15), wherein the neighboring pixels (18) physically overlap with each other.

4. Display according to claims 1 to 3, characterized in that the generation and driving of the dynamic pixels (18) is carried out at a speed that is not perceivable by the human eye.

5. Display according to claims 1 to 4, characterized in that a dynamic pixel (18) is made of at least so many dots (11, 13, 14, 15) that all basic colors given by the dots (13, 14, 15) are included.

6. Display according to claim 5, characterized in that one pixel (18) includes at least two different dots (13), which reproduce the basic colors.

7. Display according to claim 5, characterized in that one pixel (18) includes at least a red dot (13), a green dot (14) and a blue dot (15).

8. Display according to claims 1 to 7, characterized in that each dot (11, 13, 14, 15) can be driven individually.

9. Display according to claims 1 to 8, characterized in that the dots (11, 13, 14, 15) are arranged regularly on the display.

10. Display according to claims 1 to 9, characterized in that each of the dots (11, 13, 14, 15) is surrounded by a black mask (21).

11. Display according to claims 1 to 10, characterized in that a controller (19) generates overlapping pixels (18) by individual driving of the dots (11, 13, 14, 15).

12. Display according to claims 1 to 11, characterized in that each dot (11, 13, 14, 15) can be driven analog by the controller (19).

13. Display according to claims 1 to 11, characterized in that each dot (11, 13, 14, 15) can be driven digitally by the controller (19).

14. Display according to claims 1 to 13, characterized in that the dots (11, 13, 14, 15) are connected through a network (20) with the controller (19).

15. Method for driving a display with pixels made of dots, characterized in that the pixels are generated dynamically by forming a logical unit by

grouping together neighboring dots, wherein neighboring pixels are physically overlapping.

16. Method according to claim 15, characterized in that the dynamic pixels are generated and driven at a speed that is not perceivable by the human eye.

17. Method according to claim 15 and 16, characterized in that the dots to be combined into one pixel are selected such that neighboring pixels overlap only partially.

18. Method according to claim 15 to 17, characterized in that a pixel is put together in such a way that it contains all basic colors provided by the dots.

19. Method according to claim 15 to 18, characterized in that the dynamically generated pixels are each generated such that they contain the same number of different dots.

20. Method according to claim 15 to 19, characterized in that the pixels contain at least two different dots, which represent the basic colors.

Attached are 3 page(s) of drawings